Understanding the Rutherford Model

Ernest Rutherford performed an experiment in 1911 that helped him develop the solar system model of the atom. He probed the inside of the atom using small, positively charged particles called alpha particles. Based on his observations, he suggested that the atom is mostly empty space with a small, positively charged center and negatively charged electrons revolving around the outside like planets around the sun. This is the image that most people have of an atom, but how did it get that way? By answering a series of questions below and analyzing Rutherford's experiment, you will find out.

Answer the questions below based on your knowledge of the world and on the description of Rutherford's Alpha Scattering Experiment which follows.

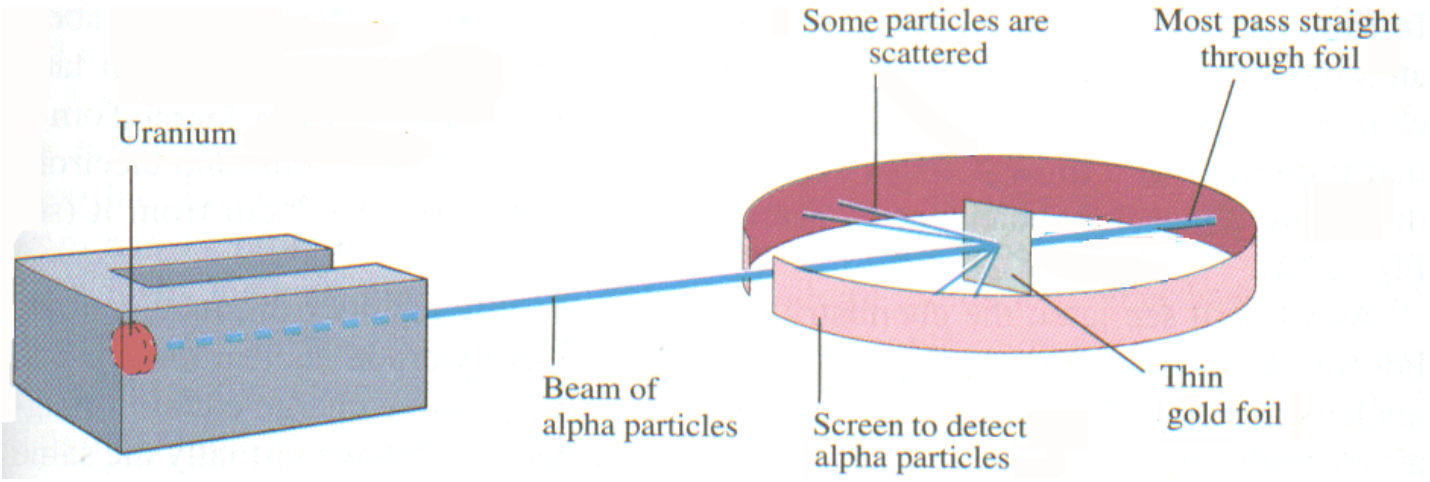
[1] If you toss a tennis ball at a brick wall, what will happen? _____

_____

[2] If you toss a tennis ball at something that looks like a solid wall, but it is actually smoke, what will happen?

_____

Rutherford performed the following experiment: He aimed a beam of high speed, positively charged particles called alpha particles (similar to our tennis ball) at a piece of solid gold foil (similar to our wall). He set up a special screen all around the foil to help him see where the particles went.



[3] According to Dalton's model, the atom is a solid sphere. What would the alpha particles do when they hit the gold foil if Dalton were correct? _____

[4] According to Thomson, the atom is a positively charged cloud with electrons scattered throughout. What would the alpha particles do when they hit the foil if Thomson were correct? _____

_____

[5] When Rutherford performed his experiment, only 1 in 20,000 alpha particles bounced straight back or were deflected greatly. The rest went straight through the gold foil.

a. What does this indicate about the probability of actually hitting anything? _____

b. What does this indicate about the size of whatever has been hit compared to the size of the gold atoms in the foil? _____

c. Is the atom mostly solid or mostly space? How do you know? _____

d. Considering the fact that alpha particles are positively charged, what must the charge be on whatever deflected them? _____

e. Based on this evidence, what is in an atom's center? _____

f. Where might the negatively charged electrons be located? _____

g. If the electrons and protons (the positively charged particles) are not near each other in the atom, why doesn't their attraction pull them together? [*HINT:* Why doesn't the Earth get pulled into the sun?] ____

[6] Based on the evidence and on your understanding of the earlier questions, propose a model of the atom. ___